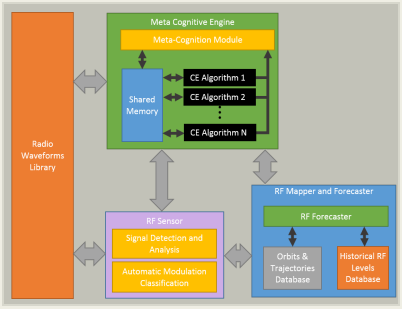
Small Business Innovation Research/Small Business Tech Transfer

MF-CRA: Multi-Function Cognitive Radio Architecture for Space Communications, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

EpiSys Science, Inc. and University of Arizona propose to develop, implement, and demonstrate Multi-Function Cognitive Radio Architecture (MF-CRA) for Space Communications, a novel software-defined radio (SDR) architecture that achieves communications configuration autonomy (CCA) with the ability to sense, detect, classify, and adapt to both time-varying communication environment and mission objectives. The innovations of the proposed MF-CRA system consists of: (i) meta-cognitive radio engines that learn which Cognitive Engine (CE) is more appropriate to provide the adaptation needed for the application scenario; and (ii) robust, computationally efficient RF sensing, signal detection, and classification algorithms compliant with the Space Telecommunications Radio System (STRS) architecture and specification. CE is an intelligent agent who observes the radio environment and chooses the best communication settings that best meet the application's goals. We propose a novel concept and design of meta-Cognitive Engine (meta-CE) which has several learning and optimization algorithms in its disposal and is learning which one is more appropriate for the application goals and the radio environment scenarios at the time of operation. To this end, we propose to develop and demonstrate the meta-CE concepts tailored for STRS applications where a meta-CE autonomously manages and controls its STRS radio waveforms and their communication parameters configurations. Our meta-CE features a dynamic RF mapping module, which will sense and record the RF signal levels as a function of the coordinates of the transceivers, the earth's atmospheric conditions, space weather, and trajectory of the transceivers so that it can anticipate the signal changes and seamlessly switch among the available links, waveforms, and parameter configuration settings. Enabling technologies for MF-CRA have been demonstrated through prototype testbed utilizing USRP radios and successful over-the-are tests.



MF-CRA: Multi-Function Cognitive Radio Architecture for Space Communications Project Image

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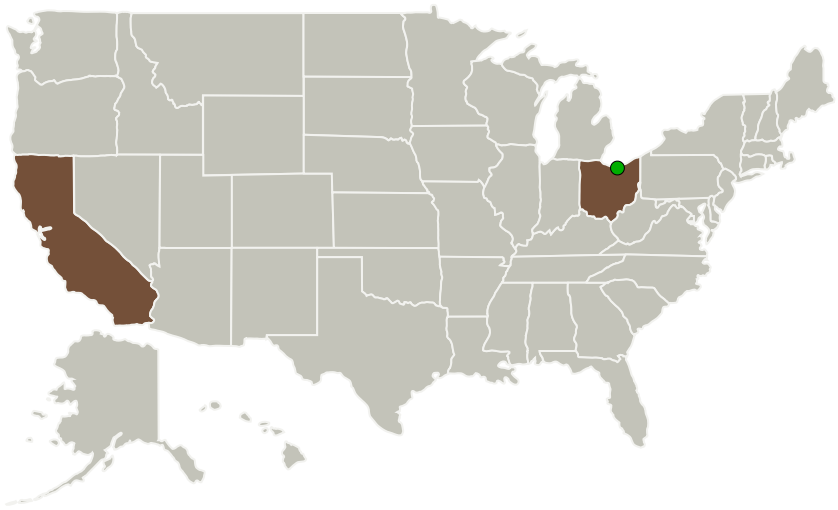
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
EpiSys Science, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB), Women-Owned Small Business (WOSB)	Poway, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

June 2014: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

EpiSys Science, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

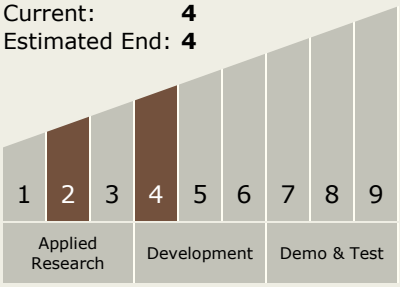
Carlos Torrez

Principal Investigator:

Bo K Ryu

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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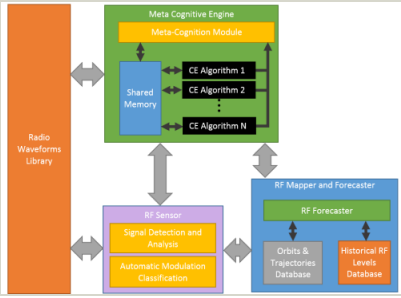
December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137756)*

Images



Project Image
MF-CRA: Multi-Function Cognitive Radio Architecture for Space Communications Project Image *(https://techport.nasa.gov/image/130748)*

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.1 Spectrum-Efficiency

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System